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Original Article

Fruit and vegetable consumption and its determinants among Saudi university students

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الملخص

أهدف البحث: ترتبط التغذية الغنية بالفواكه والخضروات مع انخفاض خطر الإصابة بالعديد من الأمراض المزمنة. وعلى الرغم من أن منظمة الصحة العالمية توصي بتناول خمس حصص على الأقل من الفواكه والخضروات يوميا، إلى أن القليل جدا يتبع هذه النصيحة. تم تصميم هذه الدراسة لتقييم مستوى استهلاك الفواكه والخضروات والعوامل المؤثرة على ذلك بين طلاب إحدى الجامعات السعودية.

طرق البحث: أجريت هذه الدراسة المقطعية على طلاب جامعة الدمام في المملكة العربية السعودية، خلال العام الدراسي ٢٠١٢م-٢٠١٣م. اختير عدد ٣٦٧ من طلاب الجامعة بطريقة عشوائية. وتم دراسة مستوى استهلاك الفواكه والخضروات باستخدام استبانة تضمنت معايير تنبؤية عن وتيرة ونوع الاستهلاك الغذائي. وحُسب مقدار الارتباط بين الاستهلاك مع مختلف المحددات المحتملة باستخدام مربع كاي.

النتائج: تضمنت الدراسة ٢٢٣ (٦٠.٧٦٪) من الذكور و ١٤٤ (٣٩.٢٣٪) من الإناث. كان متوسط عمرالمشاركين ٢٢.٤٠ ± ١.٨٣ في حين كان متوسط مؤشر كتلة الجسم ٢٣.٩ ± ٤.٧٩. لم يكن مستوى الاستهلاك مطابقا لتوصية منظمة الصحة العالمية لدى ٨٤.٤٧٪ من المشاركين. لم يكن هناك ارتباط بين الجنس ومتوسط مؤشر كتلة الجسم مع مستوى الاستهلاك. وهناك ارتباط بشكل كبير بين الأشخاص الذين يتناولون كميات كبيرة أو متوسطة من الفواكه والخضروات مع العيش مع العائلة، والتخطيط للوجبات اليومية بأنفسهم، والوعي بتوصيات منظمة الصحة العالمية حول تناول الفواكه والخضروات، والوعي بأهمية اللياقة البدنية وممارسة التمارين الرياضية بانتظام.

الاستنتاجات: تناول الفواكه والخضروات بين طلاب جامعة الدمام هو أقل بكثير من المستوى الموصى به من منظمة الصحة العالمية. هناك حاجة ماسة لتثقيف الشباب السعودي على أهمية تناول الفواكه والخضروات في وجباتهم لحياة أكثر صحة.

الكلمات المفتاحية: المحددات؛ الفواكه؛ المملكة العربية السعودية؛ طلاب الجامعة؛ الخضروات؛ منظمة الصحة العالمية

Abstract

Objectives: Diets rich in Fruits and Vegetables (F&V) are associated with reduced risk of various chronic illnesses. Although World Health Organization (WHO) recommends consumption of at least five portions of F&V a day, very few follow this advice. This study has been designed to assess F&V consumption and factors affecting its usage among students of a Saudi university.

Methods: This cross-sectional study was carried out at the University of Dammam in Kingdom of Saudi Arabia during the academic year 2012–2013. A total of 367 university students were randomly selected. F&V consumption was assessed using a questionnaire containing predictive parameters about the frequency and type of food consumption. The association of F&V consumption with various potential determinants was calculated using Chi-square test.

Results: The study included 223 (60.76%) male and 144 (39.23%) female participants. The mean age was 22.40 ± 1.83 while the mean BMI was 23.9 ± 4.79. Consumption of F&V was not at par with the WHO recommended consumption level of 84.47%. Gender and BMI were not found to be significantly associated with F&V consumption. Living with the family, planning daily menu by themselves, awareness of WHO recommendations about F&V consumption, fitness consciousness and regular exercise were significantly associated with moderate or high F&V consumption ($p < 0.001$).

Conclusions: F&V consumption in the students of university of Dammam is far less than the WHO

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recommended level. There is a dire need to educate Saudi youth about the importance of F&V in their diet for a healthier life.

Keywords: Determinants; Fruit; Kingdom of Saudi Arabia; University students; Vegetable; WHO

Introduction

While good eating habits are an essential part of a healthy lifestyle,[1] poor nutritional habits are established risk factors for chronic diseases.[2] The transition from adolescence to adulthood is a period often characterized by an unhealthy lifestyle in which young students become independent and adopt lasting health behavior patterns.[3] Therefore, this transition period can significantly shape the kind of dietary habits young adults adopt, which can have implications throughout their life.[4]

Fruit and vegetables (F&V) are important components of a healthy diet. It has been suggested that a sufficient daily consumption of F&V could help prevent major illnesses. Diets rich in F&V are associated with a decreased risk of many chronic diseases.[5–7] In addition, a high intake of F&V has been associated with a reduced incidence of certain cancers, Type 2 diabetes, and cardiovascular diseases.[8,9] Low F&V intake is a key risk factor for several non-communicable diseases that are major causes of mortality worldwide.[10,11]

According to the global burden of disease project, there are 2.7 million deaths globally which can be attributed to insufficient F&V consumption. Moreover, it has been shown that an increase of F&V intake may reduce ischemic heart disease by 31%, strokes by 19%, and stomach cancer by 19%.[12]

The exact mechanisms by which F&V reduce the risk of these chronic diseases are not precisely known. A combination of antioxidants and phytochemicals found in F&V might promote health by combating free radicals, which are linked with the early phase development of some chronic diseases.[13] F&V contain a variety of vitamins, minerals, and food compounds that have been inversely associated with cardiovascular disease risk factors.[14,15]

In 1990, the World Health Organization recommended that everyone must consume at least five portions of F&V a day to prevent some types of cancer and other chronic diseases.[16] The advice has been promoted by public health campaigns in many developed countries for nearly two decades.[17] In Kingdom of Saudi Arabia, the Ministry of Health also introduced the 'Healthy Palm Saudi dietary guidelines' that encourage Saudis to consume 2 to 4 portions of fruits and 3 to 5 portions of vegetables per day.[18] Despite all these efforts compliance is minimal. Stepwise surveys of WHO in six Arabic countries (Egypt, Iraq, Jordan, Kuwait, Kingdom of Saudi Arabia and Syria) showed that a very small percentage of the population follows these recommendations. Jordanians were better amongst the others with 43% population following the recommendations, while only 4.3% Syrians observed them. As regards the Saudi population, these studies showed only 6.55% of the population following the recommendations.[19]

Therefore, it is highly important to educate the Saudi Population to adopt the WHO's recommendations for a minimum consumption of F&V. It is very important to study the actual pattern of F&V consumption in the kingdom before initiating any campaign. A careful review of literature suggests that studies on F&V consumption patterns in the kingdom of Saudi Arabia are very few. The results of these studies have shown that the majority of the Saudi population did not meet the minimum daily recommendation for F&V intake. This was very obvious among university students.[20] In addition, to the best of our knowledge no previous study examined in detail the consumption of F&V and its determinants among university students in both genders. The objective of this study is to assess consumption patterns of F&V amongst the students at a Saudi University. We also intended to determine the association of selected physiological and psychosocial factors with F&V consumption among the students.

Materials and Methods

This cross sectional study was carried out in the academic year 2012–13 at the department of Physiology, college of medicine, University of Dammam with the approval of the university's Research & Ethics committee.

Study population and sample size calculation

The study's population included only students of the academic year 2012–13 at the main campus of University of Dammam irrespective of college or gender (N = 7987). A sample size of 367 (n) was calculated based upon total strength of students in the main campus (7987), confidence level of 95%, confidence interval (margin of error) of 5 and response distribution of 50% using an online sample size calculator.[21]

Subject recruitment

The student ID numbers available with the deanship of students affairs were used to create a unified list of all the 7987 students on the main campus (Numbered 0001 to 7987). An online random number generator software[22] was used to generate 500 Random numbers. The number of 367 (sample size) was exceeded to ensure completion of sample size in case of non-availability, declared dietary preferences or non-consent. The identified students were conveyed the message through their class leaders and by University email system to fill out the questionnaire at their time of convenience.

The students not available or refusing to participate were dropped out and subsequently replaced by the next number from the randomly generated numbers. Likewise the students who had defined dietary preferences like pesco-vegetarians, vegetarians or vegans were excluded. After final inclusion in the study, the students answered the questionnaire in direct supervision of anyone of the two authors, both of

whom had participated in the development and validation of the questionnaire.

The questionnaire was indigenously developed and it had two components, that are the predictive parameters and food frequency questionnaire.

The predictive parameters

The demographic factors noted were gender and age, while height and weight were measured. BMI was calculated. The students were categorized into underweight (BMI <18.5), normal (BMI 18.5–24.9), overweight (BMI 25–29.9) and obese (BMI $\geq$ 30).

They first question was about the place of living, and categorized as *'living with family'* and *'living alone' and living in 'shared or university accommodation'*. Next they were asked about *'who plans the food menu on a typical day'* and responses were categorized as *'family member or chef'* or *'myself'*.

The students were asked to answer 'yes' or 'no' if they were 'fitness conscious' or not. The next item on the questionnaire was *'activity level'*. The respondents were categorized into one of the three activity levels: *'Not exercising', 'irregularly exercising' and 'regularly exercising'*.

Fruit & vegetable consumption

A Food Frequency Questionnaire (FFQ)[23] was used for this study as part of questionnaire. It included 6 questions about the fruit and vegetable consumption in a week (as shown in Table 1). The answers recorded frequency of servings consumed ranging from *'Never or less than once per week'* to *'5 + per day'*. For statistical purpose we defined one serving according to the US National dietary guidelines.[24] Serving for fruit was defined as a whole fruit (e.g a medium sized apple), three-fourth cup (178 ml) fruit juice, or one-half cup (120 ml) cut fruit. Serving for vegetable was defined as 1 cup (240 ml) raw leafy vegetable (e.g lettuce), one-half cup other vegetables, or three-fourth cup (178 ml) vegetable juice.

For analysis and calculation of predictive values, we converted the responses to 3 categories 'Low' (less than once per day), 'Moderate' (1–4 per day) and 'High' (5 or 5 + per day).

Translation and validation of questionnaire

The original questionnaire was then translated into Arabic by a language expert. This was followed by translation back into English by another language expert to ensure accuracy. After appropriate corrections, the Arabic questionnaire was tested on 15 employees at the university who did not have any prior knowledge about the study. The results of these 15 questionnaires were used for validation of the questionnaire only and not included in the study. Cronbach Alpha was 0.82, which is considered reasonable.

Table 1: Questions about overall fruit and vegetable consumption.

Questions
How often do you drink 100% Pure fruit juices such as orange juice, apple juice?
Not counting juice, how often do you eat fruit?
How often do you eat dark green vegetables?
How often do you eat potatoes not including French fries, fried potatoes or potato chips?
How often do you eat carrots?
Not counting carrots, potatoes or salad, how many servings of vegetables do you usually eat?

Statistical analysis

The data was analyzed using Statistical Package for Social Sciences (SPSS) version 19. Frequencies of all responses were calculated. Chi square test was used to determine association of predictive variables with the three categories (Low, Moderate and High) of F&V consumption.

Stepwise logistic regression was applied to the socio-demographic variables showing significant association with fruit and vegetable consumption category by Chi square test and values of β coefficient, chi square; odds ratio and confidence interval were reported. For the regression analysis, moderate and high consumption were considered as a single unit while low consumption was the other unit of the outcome variable.

Results

There were 223 males (60.76%) and 144 females (39.23%) in the total of 367 randomly sampled students. The mean age of the participants was 22.40 ± 1.83 while the mean BMI was 23.9 ± 4.79. The distribution of students into the four recognized BMI categories is shown in Table 2.

Most of the participants (72.20%) were aware of the WHO recommendations. In spite of this, consumption of F&V was not on the same par with the WHO recommendations in 84.47%. The categorization of consumption as well as frequency in male and female students is shown in Table 2.

Most of the participants (76.57%) were living with their family. About 69.48% did not plan their daily menu by themselves. Although 53.3% participants were fitness conscious yet only 28.07% reported doing regular exercise.

The association of F&V consumption with socio-demographic variables is shown in Table 3. Gender and BMI were not found to be significantly associated with F&V consumption, although normal BMI subjects were more frequent in the high and moderate consumers. Amongst the high or moderate consumers of F&V are those living without family, those aware of WHO recommendations for F&V consumption, those planning daily menu by themselves, and those fitness conscious and regularly exercising were significantly ($p < 0.001$) more than the other categories.

Logistic regression analysis shown in Table 4 reflects that odds to consume F&V according to recommendations were higher if a student was living without family (OR:2.909 for living with family), aware of WHO recommendations (OR:0.206), planning menu by themselves (OR:2.102 for planning by family member/chef), fitness conscious (OR:0.102) or regularly exercising (OR: 0.193).

Table 2: Socio-demographic characteristics of the university students.

Predictive parameter	Overall (n = 367)	Male (n = 223)	Female (n = 144)
Gender (%)	100%	60.76%	39.23%
Age (Mean ± SD years)	22.40 ± 1.83	22.12 ± 1.66	22.83 ± 2.01
BMI (Mean ± SD kg/m^2)	23.9 ± 4.79	24.55 ± 5.02	22.90 ± 4.24
BMI category (kg/m^2)			
Underweight (<18.5)	36 (9.81%)	17 (7.62%)	19 (13.19%)
Normal (18.5–24.9)	207 (56.4%)	122 (54.71%)	85 (59.03%)
Overweight (25–29.9)	85 (23.16%)	53 (23.77%)	32 (22.22%)
Obese (≥30)	39 (10.63%)	31 (13.9%)	8 (5.56%)
Aware of WHO recommendations for food & vegetable consumption			
Yes (%)	265 (72.20%)	152 (68.16%)	113 (78.47%)
No (%)	102 (27.79%)	71 (31.84%)	31 (21.52%)
Fruit & vegetable consumption			
Low: (<1 serving per day)	310 (84.47%)	190 (85.20%)	120 (83.33%)
Moderate: (1–4 serving per day)	45 (12.26%)	25 (11.21%)	20 (13.89%)
High: (≥5 serving per day)	12 (3.27%)	8 (3.59%)	4 (2.78%)
Residency			
Living with family (%)	281 (76.57%)	164 (73.54%)	117 (81.25%)
Living alone (%)	19 (5.18%)	19 (8.52%)	0 (0%)
Shared/University accommodation (%)	67 (18.26%)	40 (17.94%)	27 (18.75%)
Planning of a typical day food menu			
Family member/Chef/Peer (%)	255 (69.48%)	153 (68.61%)	102 (70.83%)
Myself (%)	112 (30.52%)	70 (31.39%)	42 (29.17%)
Fitness consciousness			
Yes (%)	195 (53.13%)	67 (30.04%)	128 (88.89%)
No (%)	172 (46.87%)	156 (69.96%)	16 (11.11%)
Activity level			
Not exercising (%)	114 (31.06%)	58 (26.01%)	56 (38.89%)
Irregularly exercising (%)	150 (40.87%)	95 (42.6%)	55 (38.19%)
Regularly exercising (%)	103 (28.07%)	70 (31.39%)	33 (22.92%)

Table 3: Association of fruit and vegetable consumption with Socio-demographic variables.

Socio-demographic variables	Fruit & Vegetable Consumption			Total (n = 367)	χ^2	P
	Low (n = 310)	Moderate (n = 45)	High (n = 12)			
Gender	No. (%)	No. (%)	No. (%)	Total	0.723	0.696
Male	190 (61.29%)	25 (55.56%)	8 (66.67%)	223	(df = 2)	
Female	120 (38.71%)	20 (44.44%)	4 (33.33%)	144		
BMI category	No. (%)	No. (%)	No. (%)	Total	7.21	0.302
Underweight (<18.5)	28 (9.03%)	6 (13.33%)	2 (16.67%)	36	(df = 6)	
Normal (18.5–24.7)	169 (54.52%)	31 (65.89%)	7 (58.33%)	207		
Overweight (25–29.9)	78 (25.16%)	5 (11.11%)	2 (16.67%)	85		
Obese (≥30)	35 (11.29%)	3 (6.67%)	1 (8.33%)	39		
Residency	No. (%)	No. (%)	No. (%)	Total	55.2	0.000*
With family	248 (80%)	27 (60%)	6 (50%)	281	(df = 4)	
Alone	6 (1.94%)	8 (17.78%)	5 (41.67%)	19		
Shared/University	56 (18.06%)	10 (22.22%)	1 (8.33%)	67		
Aware of WHO recommendations for food & vegetable consumption	No. (%)	No. (%)	No. (%)	Total	12.2 (df = 2)	0.002*
Yes (%)	213 (68.71%)	41 (91.11%)	11 (91.67%)	265		
No (%)	97 (31.29%)	4 (8.89%)	1 (8.33%)	102		
Planning of a typical day food menu	No. (%)	No. (%)	No. (%)	Total	37.7	0.000*
Family member/Chef (%)	235 (75.81%)	16 (35.56%)	4 (33.33%)	255	(df = 2)	
Myself (%)	75 (24.19%)	29 (64.44%)	8 (66.67%)	112		
Fitness consciousness	No. (%)	No. (%)	No. (%)	Total	37.1	0.000*
Yes (%)	144 (46.45%)	42 (93.33%)	9 (75%)	195	(df = 2)	
No (%)	166 (53.55%)	3 (6.67%)	3 (25%)	172		
Activity level	No. (%)	No. (%)	No. (%)	Total	35.8	0.000*
Not exercising	107 (34.52%)	7 (15.56%)	0 (0%)	114	(df = 4)	
Irregularly exercising	134 (43.23%)	11 (24.44%)	5 (41.67%)	150		
Regularly exercising	69 (22.26%)	27 (60%)	7 (58.33%)	103		

* Significant with P value <0.05.

Discussion

The purpose of this study is to assess F&V consumption and factors influencing F&V intake of students at a Saudi University. We found very few of the students following WHO recommendations for F&V intake. Our findings are in parallel with similar studies conducted in female Saudi students. A study in Al-Hasa, Kingdom of Saudi Arabia found that only 22% of female university students consumed the recommended daily intake of F&V.[25] Similarly Epuru et al. in study examined F&V consumption among female students at Hail University, Kingdom of Saudi Arabia and showed that less than 30% were following WHO recommendations.[26] Studies from other Gulf countries showed similar findings. For instance, Musaiger et al.[27] showed that around a quarter of Bahraini students consumed the recommended daily amount of F&V while in another study[28] 11% of Kuwaiti adults were reported to have the recommended intake of F&V per day. Developed countries such as US,[29] Britain,[30] and German[31] also reported similar observations among university students ranging from 5% to 35% of students meeting WHO recommendation of F&V intake.

A US study reported that less than 30% of freshman students consumed the recommended amount of fruits and vegetables. The same pattern was observed in senior students.[32] According to El Ansari et al., less than 50% of university students in 4 European countries reported frequent (= several times a day/daily) consumption of fruits, whereas only 15–32% of students reported eating vegetables frequently.[33] Silliman et al. reported from a F&V consumption study on the US students that 58% of these students ate vegetables less than once a day and 64% of them ate fruit less than once a day. Only 14% of the participants in that study ate vegetables 2 to 3 times per day, 25% of female and 11% of male students ate fruit 2 to 3 times a day.[34]

Researchers have pointed out many factors that influence dietary habits. Taste is one of the most frequently identified determinants of F & V consumption[35–37] along with satiety, digestibility, appearance and texture.[35–39] Perceived health benefits of fruit and vegetables and/or a good nutritional knowledge have also been shown to have positive associations with fruit and vegetable consumption.[39,40] The self efficacy of an individual, influence of others, availability and cost are the other important determinants for F&V consumption.[35,37–39,41] Other factors include on-campus availability, level of food preparatory skills and family/peer influences.[35,42]

The most unexpected finding of our study is that the students living with their families have a higher chance of not following WHO recommendations for F&V consumption. This finding is reinforced by the result that the students planning the daily menu by themselves are more likely to follow WHO recommendations. The F&V consumption studies have traditionally been divided on the issue of pros and cons of living with family or someone else deciding about one's menu. Young adults often establish unfavorable dietary habits when leaving the parental home and entering university.[43]

Brevard et al. suggest that students living on campus consume different types of foods compared to students living at their parents' home.[44] According to El Ansari et al. living away from the parental home did not have a significant influence on the consumption of sweets, snacks, fast food or fish yet students living away from their family home did show a lower consumption of fruits, cooked/raw vegetables and meat.[33] Papadaki et al. indicated that Greek university students living away from the family home adopted unhealthy eating habits that included lowered consumption of fresh fruit, cooked and raw vegetables, oily fish and seafood whereas the intake of sugar, wine and alcoholic beverages increased.[42]

This study has clearly identified that in our study population the fitness conscious and regularly exercising subjects were consuming more F&V as compared with the ones who were not fitness conscious or not exercising. It reflects that students with both of these scientifically proven healthy habits are conscious of the potential benefits of F&V as well. It is well documented that vegetables and fruits are usually low in fat content and energy density (kcal/g), and high in water and dietary fiber.[45] Several studies suggest that

Table 4: Logistic regression analysis of the determinants of fruit and vegetable consumption.[a]

Independent variables[b]	F&V consumption		Parameter estimates (β values)	SE	χ^2	P	Unit[c]	Odds Ratio	95% Confidence intervals	
	Low No (%)	Moderate and high No (%)							Lower	Upper
Living with family	248 (88.26%)	33 (11.74%)	1.0678	0.3035	11.791	0.0004	2	2.909	1.6047	5.2739
Awareness about WHO recommendations	213 (80.38%)	52 (19.63%)	−1.5799	0.4832	15.277	0.0011	2	0.206	0.0799	0.5311
Planning of a typical day food menu by family member/chef	235 (92.16%)	20 (7.84%)	0.7432	0.3516	4.3387	0.0345	2	2.102	1.0556	4.1882
Fitness consciousness	144 (73.85%)	51 (26.15%)	−2.2822	0.4464	40.778	0.0000	2	0.102	0.0425	0.2448
Regularly exercising	69 (66.99%)	34 (33.01%)	−1.6416	0.3025	30.101	0.0000	2	0.193	0.1070	0.3504

[a] Moderate and high consumption were considered as a single unit, while low consumption was the other unit of the outcome variable.
[b] Only variables with significant association were analyzed.
[c] Odds ratio and confidence intervals were determined in terms of units in a certain factor (*ti* units) in order to minimize the influence of the scale of the predictors.

sufficient water and fiber intake, as in vegetables and fruits, increases satiety and decreases feelings of hunger after a meal.[46] Therefore, adding them to a diet can reduce a person's energy intake, and thus, help in weight management.[45] In an interesting study from US freshman students it was reported that students consuming 5 fruits or vegetables per day at baseline lost around 0.95 kg over a period of 8 months.[47] This issue has become even more important for a country like Kingdom of Saudi Arabia which is currently in the midst of an overweight epidemic.

In order to initiate changes in health behavior patterns, effective intervention programs should be developed. These programs should be designed based on the factors affecting dietary habits. Our findings taken as a whole reflect that the awareness and practice of individual awareness and practice of students might be better than that of a family. This emphasizes the need to educate the families and in particular women of the household about benefits and recommendations about F&V consumption for the family's health.

Conclusion

Fruit and vegetable consumption in the students of university of Dammam is far less than the five a day recommended by the WHO. There is a dire need to educate Saudi youth as well as families about the importance of fruit and vegetables in their diet to ensure a healthy nation. Our findings may help setup future strategic plans for intervention programs to promote F&V consumption for university students as well as households.

Authors' contributions

All authors contributed equally to this work. Ahmed Alsunni and Ahmed badar designed research; Ahmed Alsunni conducted the research; Ahmed Badar analyzed the data; both authors wrote the paper and had primary responsibility for the final content. In addition, both authors read and approved the final manuscript.

Conflict of interest

The authors have no conflict of interest to declare.

References

1. Neslisah R, Emine AY. Energy and nutrient intake and food patterns among Turkish university students. **Nutr Res Pract 2011**; 5(2): 117–123.
2. Irazusta A, Hoyos I, Irazusta J, Ruiz F, Diaz E, Gil J. Increased cardiovascular risk associated with poor nutritional habits in first-year university students. **Nutr Res 2007**; 27: 387–394.
3. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. **Obesity 2008**; 16(10): 2205–2211.
4. Cluskey M, Grobe D. College weight gain and behavior transitions: male and female differences. **J Am Diet Assoc 2009**; 109(2): 325–329.
5. Block G, Patterson B, Subar A. Fruit, vegetables, and cancer prevention: a review of the epidemiologic evidence. **Nutr Cancer 1992**; 18: 1–29.
6. Travani A, La Vecchia C. Fruit and vegetable consumption and cancer risk in a Mediterranean population. **Am J Clin Nutr 1995**; 61(suppl): 1374S–1377S.
7. Steinmetz KA, Potter JD. Vegetables, fruit, and cancer prevention: a review. **J Am Diet Assoc 1996**; 96: 1027–1039.
8. Van't Veer P, Jansen MC, Klerk M, Kok FJ. Fruits and vegetables in the prevention of cancer and cardiovascular disease. **Public Health Nutr 2000**; 3(01): 103–107.
9. Pomerleau J, Lock K, McKee M. The burden of cardiovascular disease and cancer attributable to low fruit and vegetable intake in the European Union: differences between old and new member states. **Public Health Nutr 2006**; 9: 575–583.
10. Boeing H, Bechthold A, Bub A, Ellinger S, Haller D, Kroke A, et al. Critical review: vegetables and fruit in the prevention of chronic diseases. **Eur J Nutr 2012**; 51(6): 637–663.
11. *Diet, nutrition and the prevention of chronic diseases. Report of a joint FAO/WHO expert consultation*. Geneva: World Health Organization; 2003 (WHO Technical Report Series, No. 916).
12. Lock K, Pomerleau J, Causer L, Altmann DR, McKee M. The global burden of disease attributable to low consumption of fruit and vegetables: implications for the global strategy on diet. **Bull World Health Organ 2005**; 83(2): 100–108.
13. Miller HE, Rigelhof F, Marquart L, Prakash A, Kanter M. Antioxidant content of whole grain breakfast cereals, fruit and vegetables. **J Am Coll Nutr 2000**; 19: 312S–3199S.
14. Genkinger JM, Platz EA, Hoffman SC, Comstock GW, Helzlsouer KJ. Fruit, vegetable, and antioxidant intake and all-cause, cancer, and cardiovascular disease mortality in a community-dwelling population in Washington County, Maryland. **Am J Epidemiol 2004**; 160: 1223–1233.
15. Graham IM, O'Callaghan P. The role of folic acid in the prevention of cardiovascular disease. **Curr Opin Lipidol 2000**; 11: 577–587.
16. Promoting fruit and vegetable consumption around the world. In: Global Strategy on Diet, Physical Activity and Health. Available at http://www.who.int/dietphysicalactivity/fruit/en/index.html (Last accessed on 11.09.14).
17. World Cancer Research Fund. *Food, nutrition and the prevention of cancer: a global perspective*. Washington DC: American Institute for Cancer Research; 1997.
18. Ministry of Health. (MOH). Healthy food palm. Retrieved from http://www.moh.gov.sa/en/Portal/WhatsNew/Pages/WatsNews-2013-01-14-001.aspx (Last accessed on 11.09.14).
19. Al-Othaimeen AI, Al-Nozha M, Osman AK. Obesity: an emerging problem in Saudi Arabia. Analysis of data from the National Nutrition Survey. **East Mediterr Health J 2007**; 13(2): 441–448.
20. AL-Qauhiz NM. Obesity among Saudi female university students: dietary habits and health behaviors. **J Egypt Public Health Assoc 2010**; 85(1–2): 45–59.
21. Sample size calculator. Raosoft. Available at http://www.raosoft.com/samplesize.html (Last accessed on 11.09.14).
22. Research randomizer. Available at http://www.randomizer.org/form.htm (Last accessed on 11.09.14).
23. Willett W. Food frequency methods. In: *Nutritional epidemiology*. New York: Oxford University Press; 2013.
24. Vegetables & fruits. In: *Dietary guidelines for Americans*. Available at, http://www.health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf; 2010 (Last accessed on 11.09.14).
25. AL-Otaibi HH. The pattern of fruit and vegetable consumption among Saudi university students. **Glob J Health Sci 2014**; 6(2): 155–162.
26. Epuru S, Eideh A, Albayoudh A, Alshammari E. Fruit and vegetable consumption trends among the female university students in Saudi Arabia. **Eur Sci J 2014**; 10(12): 223–237.
27. Musaiger AO, Bader Z, Al-Roomi K, D'Souza R. Dietary and lifestyle habits amongst adolescents in Bahrain. **Food Nutr Res 2011**; 55. http://dx.doi.org/10.3402/fnr.v55i0.7122.

28. Dehghan M, Al Hamad N, Yusufali AH, Nusrath F, Yusuf S, Merchant AT. Development of a semi-quantitative food frequency questionnaire for use in United Arab Emirates and Kuwait based on local foods. **Nutr J 2005**; 4(1): 18.
29. King KA, Mohl K, Bernard AL, Vidourek RA. Does involvement in healthy eating among university students differ based on exercise status and reasons for exercise. **Calif J Health Promot 2007**; 5(3): 106–119.
30. Dodd LJ, Al-Nakeeb Y, Nevill A, Forshaw MJ. Lifestyle risk factors of students: a cluster analytical approach. **Prev Med 2010**; 51(1): 73–77.
31. Keller S, Maddock JE, Hannöver W, Thyrian JR, Basler H-D. Multiple health risk behaviors in German first year university students. **Prev Med 2008**; 46(3): 189–195.
32. Racette SB, Deusinger SS, Strube MJ, Highstein GR, Deusinger RH. Changes in weight and health behaviors from freshman through senior year of college. **J Nutr Educ Behav 2008**; 40(1): 39–42.
33. El Ansari W, Stock C, Mikolajczyk RT. Relationships between food consumption and living arrangements among university students in four European countries-a cross-sectional study. **Nutr J 2012**; 11: 28.
34. Silliman K, Rodas-Fortier K, Neyman M. A survey of dietary and exercise habits and perceived barriers to following a healthy lifestyle in a college population. **Calif J Health Promot 2004**; 2(4): 82–91.
35. Ünüsan N. Fruit and vegetable consumption among Turkish university students. **Int J Vit Nutr Res 2004**; 74(5): 341–348.
36. Krebs-Smith SM, Heimendinger J, Patterson BH, Subar AF, Kessler R, Pivonka E. Psychosocial factors associated with fruit and vegetable consumption. **Am J Health Promot 1995**; 10(2): 98–104.
37. Stewart B, Tinsley A. Importance of food choice influences for working young adults. **J Am Diet Assoc 1995**; 95(2): 227–230.
38. Uetrecht CL, Greenberg M, Dwyer JJ, Sutherland S, Tobin S. Factors influencing vegetable and fruit use: implications for promotion. **Am J Health Behav 1999**; 23(3): 172–181.
39. Brug J, Lechner L, De Vries H. Psychosocial determinants of fruit and vegetable consumption. **Appetite 1995**; 25(3): 285–296.
40. Wardle J, Parmenter K, Waller J. Nutrition knowledge and food intake. **Appetite 2000**; 34(3): 269–275.
41. Cancer Society of New Zealand. *Pulp fiction – the facts harvested. A study of New Zealander's physical activity and nutrition*. Wellington, New Zealand: Cancer Society of New Zealand; 2004. Available at, http://www.cancernz.org.nz/Uploads/Pulp_Fiction_Nutrition_Analysis_Report_Final.pdf (Last accessed on 11.09.14).
42. Papadaki A, Hondros G, Scott JA, Kapsokefalou M. Eating habits of university students living at, or away from home in Greece. **Appetite 2007**; 49(1): 169–176.
43. Hoefkens C, Pieniak Z, Van Camp J, Verbeke W. Explaining the effects of a point-of-purchase nutrition-information intervention in university canteens: a structural equation modelling analysis. **Int J Behav Nutr Physic Act 2012**; 9(1): 111. http://dx.doi.org/10.1186/1479-5868-9-111.
44. Brevard PB, Ricketts CD. Residence of college students affects dietary intake, physical activity, and serum lipid levels. **J Am Diet Assoc 1996**; 96(1): 35–38.
45. Rolls BJ, Ello-Martin JA, Tohill BC. What can intervention studies tell us about the relationship between fruit and vegetable consumption and weight management? **Nutr Rev 2004**; 62(1): 1–17.
46. Howarth NC, Saltzman E, Roberts SB. Dietary fiber and weight regulation. **Nutr Rev 2001**; 59(5): 129–139.
47. Economos CD, Hildebrandt ML, Hyatt RR. College freshman stress and weight change: differences by gender. **Am J Health Behav 2008**; 32(1): 16–25.